INFRARED LIGHT BEAM COMMUNICATOR KIT

Ramsey Electronics Model No. LB-56

What's the secret behind fiber optics? - infrared light. This kit is the "guts" of those high end wireless headsets that cost hundreds of dollars. Use this kit to send voice, music, or data on a beam of invisible light. How about an invisible beam security system. And what is that remote control really saying??

- **Up to 30 foot range - 1/4 mile with simple lenses**
- **Super noise-free sound - the audio is modulated on a 30 KHz carrier - so quiet a librarian would be happy !**
- **A complete system! Kit includes separate receiver and transmitter modules for unlimited possibilities**
- **Runs on 9-12 VDC - uses standard 9 volt battery**
- **A fun and exciting kit that is not only useful but educates too!**
- **Informative manual answers questions on theory, hook-ups and uses**
- **Clear, concise assembly instruction carefully guide you to a finished kit that works FIRST time!**

RAMSEY

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RAMSEY TRANSMITTER KITS

- FM-10 FM Stereo Transmitter
- FM-1,2,3,4 FM Wireless Microphones
- PB-1 Telephone Transmitter

RAMSEY RECEIVER KITS

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- AR-1 Aircraft Band Receiver
- SR-1 Shortwave Receiver
- AA-7 Active Antenna
- SC-1 Shortwave Converter

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- PH-10 Peak hold Meter
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- QRP Power Amplifiers

RAMSEY MINI-KITS

Many other kits are available for hobby, school, Scouts and just plain FUN. New kits are always under development. Write or call for our free Ramsey catalog.

INFRARED LIGHT BEAM COMMUNICATOR KIT INSTRUCTION MANUAL
Ramsey Electronics publication No, MLB-56 Rev 1.2
(First printing: January 1993)

Ramsey Publication No. MLB-56
Price $5.00

KIT ASSEMBLY AND INSTRUCTION MANUAL FOR

LIGHT BEAM COMMUNICATOR

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RAMSEY

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INTRODUCTION:

Have you ever wondered how your TV, VCR, or stereo remote control units "talk" to the appliance?

The Ramsey LB-56 infrared communications kit will help you to discover how invisible light can be used to transmit information. You can also explore a previously undetectable range of frequencies. The communicator is actually two kits in one, a transmitter to send the information and a receiver to receive and demodulate this information.

The infrared communicator was designed to be used either separately or as a transceiver.This can be accomplished quite easily by simply by 'breaking' the transmitter and receiver PC board into two independent units. As you have probably noticed by now, the included circuit board has two tell-tale slots near the center of the circuit board. These slots may separate the two units. Before we begin building, we'll describe how to separate these units, but you'll need to decide your usage before you begin assembly.

The LB-5 Infrared Light Beam Receiver converts infrared light signals into intelligible audio sound which may be heard directly through a speaker or earphones. In addition to receiving voice, music or tone transmissions from the LB-6 Transmitter, it lets you hear the signals emitted by any other infra-red device such as a TV or VCR remote control unit. This capability may have some interesting possibilities for experimenters, especially because "extra" remote control units are readily available in surplus markets. In addition, this versatile light beam receiver can serve as an interesting foundation for experimental "listening" to light beams of various kinds. Consider also that infrared energy is also produced by heat, so the receiver doubles as an infrared "leakage" detector.

The companion LB-6 Infrared Light Beam Transmitter is a complete six-transistor 30KHz AM transmitter. It has an output range of 30 feet as supplied, or up to a quarter mile with lenses used on both transmitter and receiver. The transmitter can accept a variety of input signals from microphone inputs to music and audio to data. This transmitter "mimics" the way many infrared remote control units send information.

Throughout the rest of this manual, "infrared" will be abbreviated as "IR" as needed.

LB-56 CIRCUIT DESCRIPTION:

LB-5 TRANSMITTER

The transmitter circuit consists of an audio input/amplifier stage, using transistor Q3. This audio signal is then fed to the AM modulator stage consisting of transistors Q2 and Q1. Transistors Q5 and Q6 form a thirty KHz oscillator which is amplified by Q4. When audio is applied to the input circuitry, the signal is modulated on the carrier. The IR diode "transmits" this resultant waveform.

LB-6 RECEIVER

Diode D4 "sees" the IR light. This signal is then amplified by Q10 and Q8. Amplitude modulated signals are detected by diode D3 and the resulting audio is amplified by transistor Q7. The audio level can be adjusted using R14, which is fed into the LM386 audio amplifier IC, which in turn drives a small speaker or earphone.

RAMSEY "Learn-As-You-Build" KIT ASSEMBLY:

We have a twofold "strategy" for the order of the following kit assembly steps. First, we install parts in physical relationship to each other, so there's minimal chance of inserting wires into wrong holes. Second, whenever possible, we install in an order that fits our "Learn-As-You Build" Kit building philosophy.

FOR EACH PART, OUR WORD "INSTALL" ALWAYS MEANS THESE STEPS:

1. Pick the CORRECT part value to start with.
2. Insert it into the CORRECT PC board location.
3. ORIENT it correctly, which means: PLEASE follow the PC board drawing and the written directions for ALL parts where there's a right way AND a wrong way to solder it in. (Diode bands, electrolytic capacitor polarity, transistor shapes, dotted or notched ends of IC's, and so forth.)
4. Push the component as close to the component side as is mechanically possible. This will keep the component side neat and prevent parts from "radiating" signals to undesired locations.
5. Solder ALL connections unless directed otherwise. Use enough heat and solder flow for clean, shiny, completed connections. Don't be afraid of ANY pen-style soldering iron having enough heat to damage a component.
6. Trim or "nip" excess wire lengths after soldering.

NOTE: Save some of the longer wire scraps nipped from resistors and capacitors. These will be used to form wire jumpers (JMP1, etc.) to be soldered in just like parts during these construction steps.

LB-56 LIGHT BEAM COMMUNICATOR KIT PARTS LIST:

CAPACITORS

- ☐ 3 .001 µf disc capacitors [C4,5,14] (marked 102 or .001)
- ☐ 5 .01 µf disc capacitor [C2,9,10,12,13] (marked 103 or .01 or 10nf)
- ☐ 2 .1 µf disc capacitors [C11,15] (marked 104 or .1)
- ☐ 3 2.2 µf electrolytic capacitor [C1,3,8]
- ☐ 2 220 µf electrolytic capacitor [C6,7]

RESISTORS

- ☐ 1 2 ohm resistor (red-black-gold) [R18]
- ☐ 1 51 ohm resistor (green-brown-black) [R6]
- ☐ 6 1K ohm resistor (brown-black-red) [R3,7,8,11,12,16]
- ☐ 1 4.7K ohm resistor (yellow-violet-red) [R1]
- ☐ 4 10K ohm resistor (brown-black- orange) [R15,19,20,21]
- ☐ 2 47K ohm resistor (yellow-violet- orange) [R9,10]
- ☐ 3 100K ohm resistor (brown-black-yellow) [R5,13,17]
- ☐ 1 1M ohm resistor (brown-black-green) [R 22]
- ☐ 2 2.2K PC-mount potentiometer [R2,4]
- ☐ 1 10K ohms PC mount potentiometer [R14]

SEMICONDUCTORS

- ☐ 1 Infrared Emitter diode [D1]
- ☐ 1 Infrared Detector Diode [D4]
- ☐ 1 1N270 or similar small diode [D3]
- ☐ 9 NPN Transistors, type 2N3904 or equivalent [Q1-8, 10]
- ☐ 1 LM 386 IC [U1]

HARDWARE

- ☐ 1 LB-56 printed circuit board
- ☐ 1 Miniature PC mount earphone / speaker jack [J1]
- ☐ 1 RCA phono PC mount jack [J2]
- ☐ 1 DPDT push switch [S1]
- ☐ 1 9 volt battery hold down clamp
- ☐ 1 9 volt battery snap connector

REQUIRED, NOT SUPPLIED

- ☐ 1 9 volt alkaline or heavy duty battery
- ☐ 1 Speaker or headphones

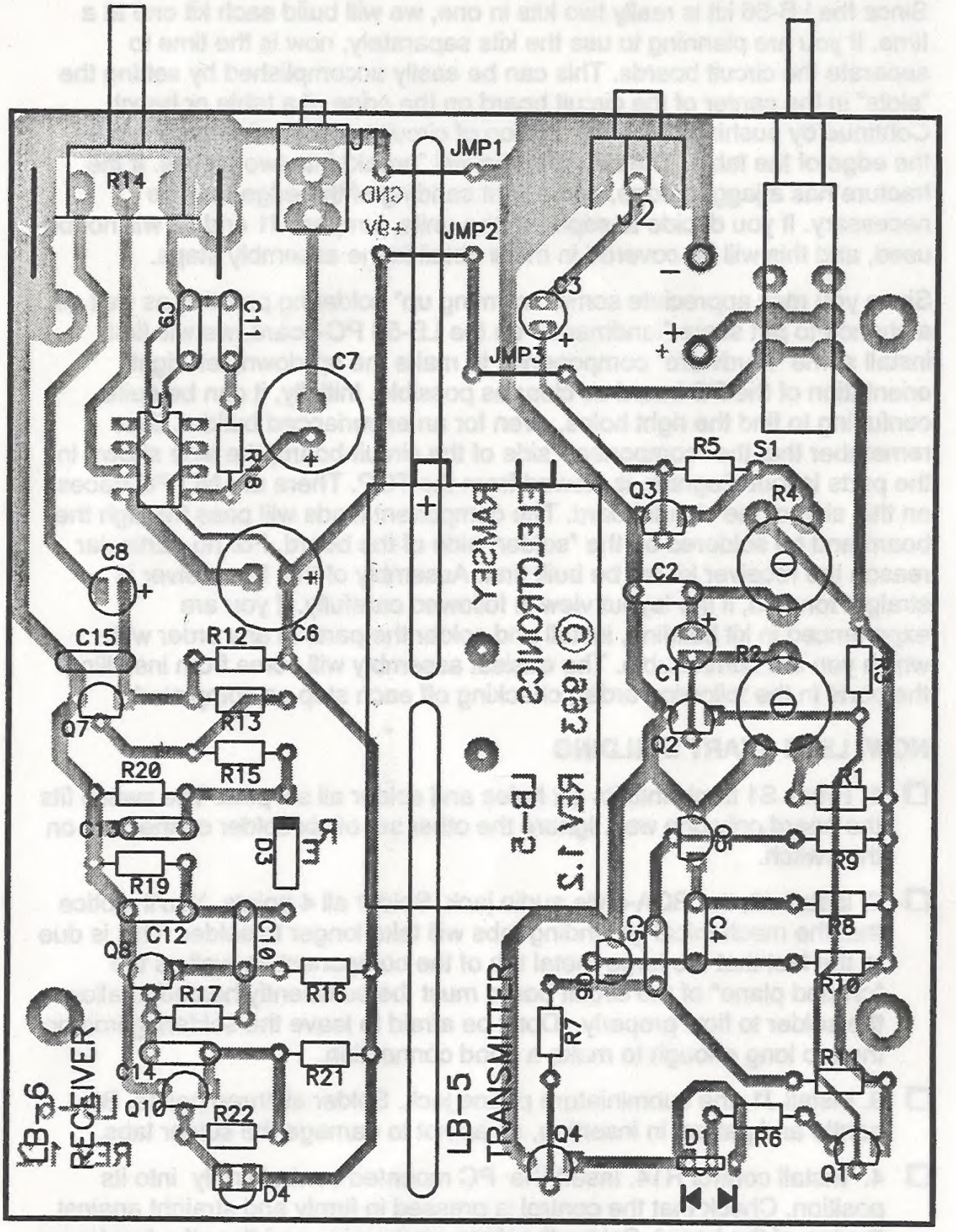
OPTIONAL

- ☐ 1 Ramsey case and knob set (model CLB)

NOTE CONCERNING THE AUDIO OUTPUT JACK

Your receiver kit is supplied with a standard subminiature 2.5 mm (3/32") audio output jack, which mates with commonly available earphone plugs and adapters available at Radio Shack, such as 274-290 (plug) or 274-327 (adapter for 1/8" mono plug). If you prefer to use another size and style jack, we suggest that you still install the original jack and then wire your own jack in parallel with it rather than rough up the PC board to accommodate your jack.

PARTS LAYOUT:



FIRST ASSEMBLY STEPS:

Since the LB-56 kit is really two kits in one, we will build each kit one at a time. If you are planning to use the kits separately, now is the time to separate the circuit boards. This can be easily accomplished by setting the "slots" in the center of the circuit board on the edge of a table or bench. Continue by pushing down the section of circuit board that's hanging over the edge of the table. The circuit board will "break" into two pieces. If the fracture has a jagged edge, some light sanding of the edge may be necessary. If you decide to separate the units, jumpers J1 and J2 will not be used, and this will be covered in more detail in the assembly steps.

Since you may appreciate some "warming up" soldering practice as well as a chance to put some "landmarks" on the LB-56 PC-board, we will first install some "hardware" components, to make the up-down, left-right orientation of the PC board as clear as possible. Initially, it can be quite confusing to find the right holes, even for an experienced builder. Just remember that the "component" side of the circuit board, the side shown in the parts layout diagram, is viewed from the TOP. There are NO PC traces on this side of the circuit board. The component leads will pass through the board and be soldered on the "solder" side of the board. For no particular reason the receiver kit will be built first. Assembly of this IR receiver is straight forward, if the layout view is followed carefully. If you are experienced in kit building, install and solder the parts in any order with which you are comfortable. The easiest assembly will come from installing the parts in the following order, checking off each step as completed.

NOW, LETS START BUILDING

- ☐ 1. Press S1 firmly into its six holes and solder all six pins. The switch fits the board only one way. Ignore the other set of six solder connectors on the switch.
- ☐ 2. Install J2, the RCA-style audio jack. Solder all 4 points. You'll notice that the mechanical grounding tabs will take longer to solder. This is due to the fact that the large metal tab of the component as well as the "ground plane" of the circuit board must be sufficiently heated to allow the solder to flow properly. Don't be afraid to leave the soldering iron on the tab long enough to make a good connection.
- ☐ 3. Install J1, the subminiature phone jack. Solder all three points. Be gentle and patient in inserting, so as not to damage the solder tabs.
- ☐ 4. Install control R14. Insert the PC mounted control firmly into its position. Check that the control is pressed in firmly and straight against the top of the board. Solder the three center pins and then the two larger mechanical mounting tabs. Use enough solder for a solid connection. Also, if you plan to use an enclosure other than the custom Ramsey

case and knob kit, you may wish to locate the controls differently than provided by the PC board. In this case, the control lugs should be wired to the PC board using your own insulated hookup wire. Keep the wire as short as possible for neat installation.

- ☐ 5. Install D4 the IR detector. Notice that this component has a very distinctive shape, a bulb like end that faces away from the circuit board as well as a slant or "chamfer" edge that faces toward the center of the circuit board.
- ☐ 6. Install R22, 1 Megohm [brown-black-green] located behind D4.
- ☐ 7. Install Q10, the 2N3904 transistor. The PC-board drawing clearly shows how the flat side of each transistor points in relation to other parts. To install a transistor, press its three leads in place as far as they will go without forcing; the wires may be spread as needed to hold it in place before soldering. Don't hesitate to use sufficient soldering heat to make good connections.
- ☐ 8. Install R21, 10K ohm [brown-black-orange].
- ☐ 9. Install C14, .001 µf disc capacitor [marked .001 or 102]. We've just completed the "eye" of the IR receiver. This part of the circuit will detect IR light.
- ☐ 10. Install R17, 100K ohm [brown-black-yellow].
- ☐ 11. Install R16, 1K ohm resistor [brown black red].
- ☐ 12. Install Q8, 2N3904. Note that the flat side faces resistor R17.
- ☐ 13. Install C10, .01 µf disc capacitor [marked .01 or 103 or 10nf]. Please note that this part is "rotated" 90 degrees compared to all the previously installed components. This is a common practice, just remember to keep an eye on the PC-board diagram.
- ☐ 14. Install D3, 1N270 diode. Notice that this diode is in a glass package, and is particularly fragile. When bending the diode "leads", it is best to strain relief the diode lead on the component side of the part with a pair of needle nose pliers. Then bend the component lead with a finger or pliers. Note that the diode is "polarized". The diode itself is marked with a black band. This is the cathode end of the diode. Special care should be taken to orient the component correctly.
- ☐ 15. Install C12, .01 µf disc capacitor [marked .01 or 103 or 10nf].
- ☐ 16. Install R19, 10K ohm [brown-black-orange]. Remember to save some of your trimmed leads to use as "jumper" wires later.
- ☐ 17. Install C13, .01 µf disc capacitor [marked .01 or 103 or 10nf]

- ❒ 18. Install R20, 10K ohm [brown-black-orange]. You've now completed the AM envelope detector. This circuit removes the audio information from the IR carrier.
- ❒ 19. Install R15, 10K ohms [brown-black-orange].
- ❒ 20. Install R13, 100K ohms [brown-black-yellow].
- ❒ 21. Install R12, 1K ohm [brown-black-red].
- ❒ 22. Install Q7, 2N3904 transistor. Notice that the flat side faces R20.
- ❒ 23. Install C15, .1 µf disc capacitor [marked .1 or 104]
- ❒ 24. Install C8, 2.2 µf electrolytic capacitor. Electrolytic capacitors are polarized and must be installed correctly. They are usually marked with a black stripe and a (-) indicating their negative lead, while PC boards will usually indicate the (+) hole.
- ❒ 25a. Next we'll install the LM 386 audio amplifier IC. Use care when inserting the IC into the circuit board, so as not to bend one of the pins. This prevents it from passing through the circuit board. Note also that one end of the IC is marked by a dot, notch or band; this end MUST be oriented as shown on the PC board layout diagram.
- ❒ 25b. Install C6, 220 µf electrolytic capacitor. Check to make sure the polarity is correct.
- ❒ 26. Install R18, 2 ohm [red-black-gold]
- ❒ 27. Install C7, 220 µf electrolytic capacitor. Check to make sure the polarity is correct.
- ❒ 28. Install C11, .1 µf disc capacitor [marked .1 or 104]
- ❒ 29. Install C9, .01 µf disc capacitor [marked .01 or 103 or 10nf]

CONGRATULATIONS

Your IR light beam receiver is completed! Take a minute to step back and have a look at your work. If you have the patience, we suggest a short break. Then, take a magnifying lens and a bright light and examine all your solder joints, touching up any connection which appears less than perfect. Make sure all excess leads have been trimmed, and that there's not one bent back flat against the board, probably causing a short, Brush the solder side of the board with a stiff brush to make sure that no loose wire trimmings or solder drippings (tsk tsk) are lodged between connections.

Now we'll install the battery and/or power supply connections. If the kits were separated omit these steps and pick up after step number 33.

- ❒ 30. Using a scrap resistor lead, form a "jumper" wire to insert in the printed circuit board in the JMP 1 position. This connects the ground of the receiver to the transmitter printed circuit traces
- ❒ 31. Place another "jumper" in the JMP 2 position. This connects the positive power voltage between the transmitter and receiver circuit traces.
- ❒ 32. Install the battery snap terminal in the two holes adjacent to S1, making sure that the positive (red) lead is inserted into the (+) hole on the PC board.
- ❒ 33. The battery bracket may be attached in a variety of ways. A wire jumper can be passed through the two holes on the PC board, then both ends soldered on the underside of the board.

If the circuit boards were separated initially, the positive supply connection to the receiver circuit board will be at the JMP 2 location. The negative connection will be at the JMP 1 connection to the LB-5 circuit board.

If you wish to "try out" your receiver at this time, you can connect 9-12VDC to the power or battery terminals. Plug in a small speaker or earphone to jack J1. If you hold an IR remote control unit facing the detector diode D4, you should "hear" the remote control's signal.

Next we'll assemble the IR transmitter portion of the kit.

- ❒ 34. Install D1, the IR emitter. Notice that the circuit board has been laid out to accommodate several styles of LED packages. Notice also that the component has a "bump" on one side of the package. Be sure that this side faces out. The longer lead of the "diode" is the anode connection. This corresponds to the "triangle" portion of the schematic symbol. When installing this part there will be an "extra" hole in the circuit board.

- ❒ 35. Install Q4, 2N3904 transistor. Be sure the flat side faces the outside of the circuit board. Remember to gently press the leads in as far as they will go, without forcing them. Don't worry too much about heating the component with your iron, a pencil iron cannot generate enough heat to damage the transistors.
- ❒ 36. Install R7, 1K ohm [brown-black-red].
- ❒ 37. Install R6, 51 ohm [green-brown-black].
- ❒ 38. Install Q6, 2N3904 transistor. Watch the orientation! The flat side faces toward R7.
- ❒ 39. In the same manner, install Q1, another 2N3904 transistor. Notice that the flat side faces toward the outside of the circuit board.
- ❒ 40. Install R11, 1K ohm [brown-black-red].
- ❒ 41. Install C5, .001 µf disc capacitor [marked .001 or 102].
- ❒ 42. Install C4, .001 µf disc capacitor [marked .001 or 102].
- ❒ 43. Install Q5, 2N3904 transistor. The flat side faces toward the center of the circuit board.
- ❒ 44. Install R10, 47K ohm [yellow-violet-orange].
- ❒ 45. Install R8, 1K ohm [brown-black-red].
- ❒ 46. Install R9, 47K ohm [yellow-violet-orange]. We've now completed the output stage as well as the 30 KHz carrier oscillator in the transmitter section. This will turn the IR LED on and off at a 30 KHz rate.
- ❒ 47. Install R1, 4.7K ohm [yellow-violet-red].
- ❒ 48. Install R3, 1K ohm [brown-black-red]
- ❒ 49. Install R2, the 2.2K ohm potentiometer. Examine the 2.2K trimmer potentiometers. Notice the three "leads" that extend from the component. When placing these components, make sure the leads line up correctly with the holes in the circuit board. Gently push the component in place without bending the components' leads.
- ❒ 50. Install R4, the other PC mount 2.2K ohm potentiometer.
- ❒ 51. Install Q2, 2N3904 transistor. Notice that the flat side faces Q5.
- ❒ 52. Install C1, 2.2 µf electrolytic capacitor. Be sure to check the polarity and orient the part correctly .
- ❒ 53. Install C2, .01 µf disc capacitor [marked 103 or .01 or 10nf]
- ❒ 54. Install Q3, the final 2N3904 transistor. The flat side faces C2.
- ❒ 55. Install R5, 100K ohm [brown-black-yellow].
- ❒ 56. Using a scrap resistor lead, form a "jumper" wire to insert in the printed circuit board in the JMP 3 position.

☐ 57. Install C3, 2.2 µf electrolytic capacitor. Note the polarity. See the parts placement diagram for correct orientation.

You've just completed the audio amplifier portion of the IR transmitter! This section of the circuit will take whatever information is presented to the input, amplify it, and "modulate" the 30KHz carrier with that information.

Take some time now to re-check your solder connections. Be certain that there are no solder "bridges" between components or foil runs. Make sure all component leads are trimmed and resolder any connection which is less than perfect.

SET-UP AND TESTING:

Please note that this test procedure was written for the LB-56 unit unseparated. If you have "broken" the PC boards into two pieces, some additional connections (i.e. independent power supply connections) may be required. It is also important to note that both the transmitting IR LED and the IR detector both face in the same direction, so it is helpful to point this end of the circuit board towards a reflective surface (approx. 6" to 1' away). In normal room light without filters or lenses, the communications range of the LB-56 is limited. This is because the IR detector diode is easily saturated by other light and no focusing of the transmitted signal is provided. This can be corrected with simple lenses and filters and will be described later.

☐ 1. Connect a microphone or other audio source to the J2 input. Note that the center of the jack should go to the "hot" input connection.

☐ 2. Connect a small speaker or earphone to the J1 audio output. It's always a good practice to turn the audio level pot, R14, all the way down (full CCW) before starting.

☐ 3. Connect a fresh 9VDC battery to the circuit. Turn the power switch to the "on" position.

☐ 4. Adjust R2, the PC mounted trimmer so that one-half the supply voltage (4.5 VDC) is measured at the emitter of Q1 at the junction of R6.

☐ 5. Adjust the audio gain pot, R14, for best quality audio.

TROUBLE-SHOOTING HINTS:

If your light beam communicator does not work, recheck the following:

- Correct orientation of all transistor flat sides.
- Correct resistor and capacitor placement, " that's not a 10K where a 1K should be?"
- All solder connections - this is the most frequent cause of failure. Check these connections under a bright light and use a magnifying lens. Touch up any connections that are less than perfect.

EXPERIMENTING WITH YOUR LB-56:

Because of the various ways you may choose to use your communicator, testing and experimentation are the only practical assurance of optimum performance of your project. Here are a few facts to remember about light beam transmission:

- You cannot see IR light. You'll need to get used to that reality when building this communications kit. That IR emitter is not going to "light up" even though you'll be able to hear its modulated signal just fine in your receiver!
- The intensity of a light beam follows the "inverse square law". This gem from your physics textbook states that light intensity is inversely proportional to the square of the distance between the transmitter and the receiver. A practical illustration of this law is as follows: If you change the distance between the transmitter and receiver from 1 foot to 3 feet, you have reduced the intensity to 1/9 of the previous intensity even though you have moved only 2 feet! Moving away just 1 more foot reduces the intensity at 4 feet to 1/16 of what it was 1 foot away.
- IR filters are commonly used to cut back other portions of the light spectrum. This can prevent ambient light from saturating and desensitizing IR diodes. Typically, a deep red lens filter is used. This will increase the range of your IR communicator. Thin, deep red plexiglass is excellent and available from a variety of sources. Virtually all printing companies use various transparent red materials in their work because it blocks out that part of the light spectrum which effects film, plates, and photo-sensitive supplies.
- Convex lenses are to light beam transmission what amplifiers and beam antennas are to radio and television transmitters. They focus the light energy from the transmitter or to the receiver and can "undo" the effects of the inverse square law. The use of simple lenses can dramatically increase the range of your communications. Lenses and other optical supplies can be purchased from Edmund Scientific Company, 101 East Glouster Pike, Barrington, NJ 08007.

APPLICATION IDEAS:

Used separately, the light beam transmitter and receiver can establish a unique communications link for audio or data. This is essentially what those high end wireless headsets consist of. Wire the transmitter to the auxiliary output of a Hi-Fi and the receiver to a set of "wireless" earphones! Or how about an infrared "repeater". You can use the receiver to detect your television, VCR, or stereo remote control unit and re-transmit it around corners or from twice the distance you could originally! Note that the use of light in electronics communications makes them immune to the kinds of interference or unintended interception associated with radio transmission and reception. Also, the design of the transmitter and receiver on the same circuit board provides for easy "duplex" operation. This allows you to easily combine two kits as sort of a light beam "walkie-talkie" capable of transmitting and receiving information at the same time. Consider also that infrared energy is also associated with heat. Try "listening" to a candle or other heat sources. How about using the receiver to detect heat losses where cold drafts are found.

Remember that an understanding of light and optics is the key to top performance.

ENCLOSURE RECOMMENDATIONS:

Your finished communicator can be installed in a variety of enclosures of your own design and choosing. You might be planning to combine several Ramsey circuit boards in a single enclosure. Use of the inexpensive and attractive Ramsey case and knob kit will give your unit that finished look and increase its resale value. These sturdy black instrument cases are supplied with neatly-lettered front and rear panels, knobs, rubber feet and mounting screws.

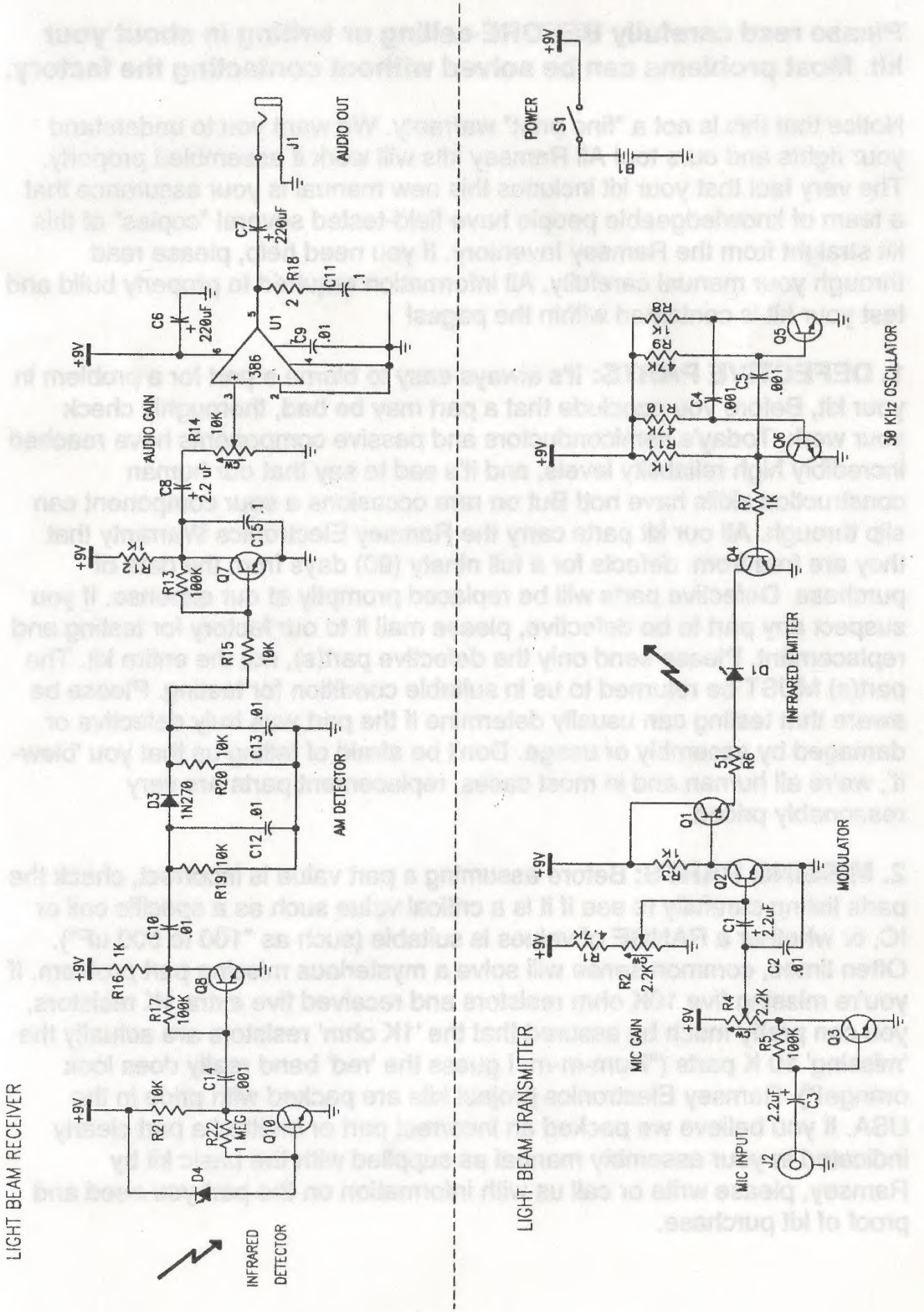
While we believe that the Ramsey enclosure and knob option is a fine value for finishing off your Ramsey light beam communicator, we are happy to give you an additional suggestion

. If your first goal is economy and rugged portability, you will find that the circuit board can be mounted nicely in a standard VHS videotape storage box, which also gives room for a speaker or earphone storage. The controls are easily mounted at one end of such a box. It may be necessary to cut away the molded posts which secure the tape cassette itself. These storage boxes come in several styles, so pick one that looks truly practical as a project enclosure.

CONCLUSION:

If you've enjoyed this kit, be sure to check out the entire Ramsey kit line. We have a whole series of hobby and electronic kits that not only teach state-of-the-art technology, but are fun and easy to build, too! Call or write for our free catalog.

SCHEMATIC DIAGRAM:



The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully. All information required to properly build and test your kit is contained within the pages!

1. DEFECTIVE PARTS: It's always easy to blame a part for a problem in your kit, Before you conclude that a part may be bad, thoroughly check your work. Today's semiconductors and passive components have reached incredibly high reliability levels, and it's sad to say that our human construction skills have not! But on rare occasions a sour component can slip through. All our kit parts carry the Ramsey Electronics Warranty that they are free from defects for a full ninety (90) days from the date of purchase. Defective parts will be replaced promptly at our expense. If you suspect any part to be defective, please mail it to our factory for testing and replacement. Please send only the defective part(s), not the entire kit. The part(s) MUST be returned to us in suitable condition for testing. Please be aware that testing can usually determine if the part was truly defective or damaged by assembly or usage. Don't be afraid of telling us that you 'blew-it', we're all human and in most cases, replacement parts are very reasonably priced.

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of $18.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.

The repair is $36.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

4. REFUNDS: You are given ten (10) days to examine our products. If you are not satisfied, you may return your unassembled kit with all the parts and instructions and proof of purchase to the factory for a full refund. The return package should be packed securely. Insurance is recommended. Please do not cause needless delays, read all information carefully.

INFRARED LIGHT BEAM COMMUNICATOR KIT
Quick Reference Page Guide

REQUIRED TOOLS

- Soldering Iron (Radio Shack #RS64-2072)
- Thin Rosin Core Solder (RS64-025)
- Needle Nose Pliers (RS64-1844)
- Small Diagonal Cutters (RS64-1845)
- <OR> Complete Soldering Tool Set (RS64-2801)

ADDITIONAL SUGGESTED ITEMS

- Soldering Iron Holder/Cleaner (RS64-2078)
- Holder for PC Board/Parts (RS64-2094)

TOTAL SOLDER POINTS

154

ESTIMATED ASSEMBLY TIME

Beginner.....4.5 hrs
Intermediate.....2.5 hrs
Advanced .....1.8 hrs

Price: $5.00
Ramsey Publication No. MLB-56
Assembly and Instruction manual for:
RAMSEY MODEL NO. LB-56

RAMSEY

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